8. RETENTION FRACTIONS FOR SIZE DISTRIBUTIONS OTHER THAN 1 AMAD

After a short time post single intake, the following approximate relationship exists between the total body IRFs for different aerosol sizes between 0.2 and 10 μm.

$$\frac{IRF(AMAD)}{IRF\ (1\mu m)} = \sum_T \left[f_{N-P} \times \frac{H_{50T}W_T}{\sum_T H_{50T}W_T} \times \frac{D_{N-P}(AMAD)}{D_{N-P}(1\ \mu m)} + f_{T-B} \times \frac{H_{50T}W_T}{\sum_T H_{50T}W_T} \times \frac{D_{T-B}(AMAD)}{D_{T-B}(1\ \mu m)} + f_P \times \frac{H_{50T}W_T}{\sum_T H_{50T}W_T} \times \frac{D_P(AMAD)}{D_P(1\ \mu m)} \right] \qquad (B.8.1)$$

where:

$IRF(AMAD)$ = total body intake retention fraction for inhalation of Class D, W or Y compounds for AMAD of interest,

$IRF\ (1\mu m)$ = total body intake retention fraction for inhalation of 1 μm AMAD aerosols, and these IRFs are given in Appendix B,

f_{N-P}, f_{T-B} and f_P = the fraction of committed dose equivalent in the tissue T resulting from deposition in the N-P, T-B and P regions respectively,

$H_{50T}W_T$ = the weighted committed dose equivalent in tissue T per unit intake,

D_{N-P}, D_{T-B} and D_P = regional deposition fractions for an aerosol entering the respiratory system.

The time at which equation B.8.1 is valid is a time post intake which is variable between classes of compounds. For Class D, the time at which the equation yields satisfactory results is less than 1 day, for Class W, the time is about 7 days post intake and for Class Y, the time is about 9 days post intake. Values for f_{N-P}, f_{T-B}, f_P and $H_{50T}W_T$, which are to be used in equation B.8.1, are listed in Supplements to ICRP Publication 30 (ICRP79). Values for D_{N-P}, D_{T-B} and D_P are given in Table B.8.1.

Table B.8.1 Regional Deposition Fractions for Aerosols with AMADs Between 0.2 and 10 μm.

	Aerosol AMAD, μm			
	0.2	0.5	0.7	1
D_{N-P}	4.98E-02	1.61E-01	2.27E-01	3.10E-01
D_{T-B}	8.00E-02	8.00E-02	8.00E-02	8.00E-02
D_P	5.00E-01	3.50E-01	2.99E-01	1.67E-01
Total Deposition	6.30E-01	5.91E-01	6.06E-01	6.68E-01

Typo

	Aerosol AMAD, μm			
	2	5	7	10
D_{N-P}	5.00E-01	7.44E-01	8.14E-01	8.75E-01
D_{T-B}	8.00E-02	8.00E-02	8.00E-02	8.00E-02
D_P	1.67E-01	8.80E-02	6.74E-02	4.98E-02
Total Deposition	6.68E-01	9.12E-01	9.61E-01	1.00E-00

A plot of total body IRF versus time post intake for Class D Cs-137, Class W Co-60 and Class Y Pu-239 is given as Figure B.8.1. The values for IRFs were computed for different aerosol sizes as described in Section 2 and not from equation B.8.1. After some time post intake, the curves for a given nuclide for different AMADs are parallel, and it is at these times that equation B.8.1 applies. For example, at 100 days post intake of 0.2 um AMAD Co-60, the IRF obtained from equation B.8.1. is 9.7E-02 for the total body. The IRF from computation in the manner described in Section 2 is 1.0E-01. The approximate method relies on a summation over all tissues, but only those tissues contributing greater than 10% to the effective dose equivalent are listed in ICRP Publication 30 Supplements. Thus, the IRFs derived from equation B.8.1 are a few % less than the IRFs derived by the method described in Section 2.

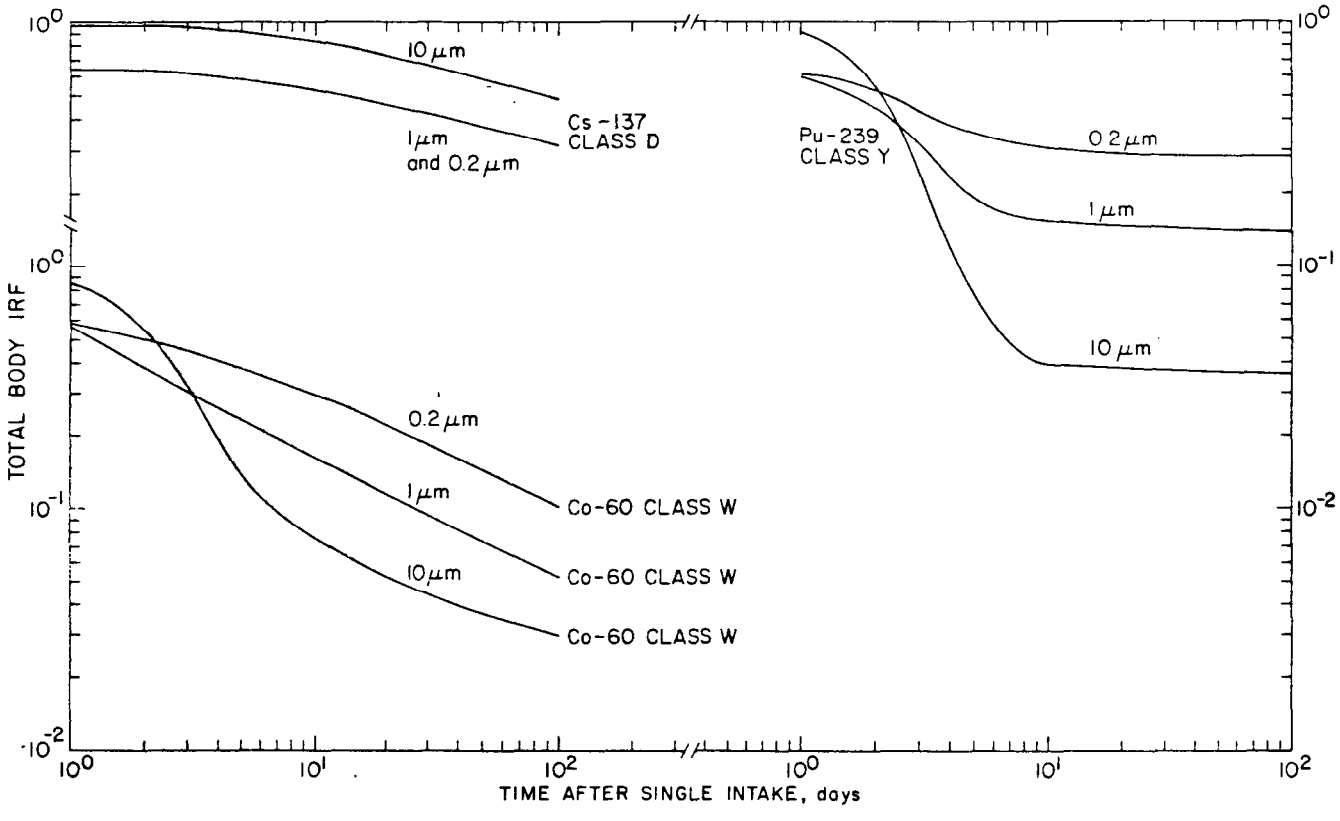

Figure B.8.1 Inhalation intake retention functions for 0.2, 1 and 10 micrometer aerosols of Class D Cs-137, Class W Co-60 and Class Y Pu-239